KOOTENAI DEVELOPMENT IMPOUNDMENT DAM

DECEMBER 26TH, 2007 ROUTINE INSPECTION REPORT

BILLMAYER & HAFFERMAN ENGINEERING INC.

February 23, 2008

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EXECUTIVE SUMMARY

A winter 2007 site inspection and routine monitoring site visit was made Wednesday, December 26th, 2007. Projects completed included;

1. Obtain Piezometer readings
2. Inspect the embankment dam
3. Inspected the repair in the open chute concrete spillway
4. Read V-notch weirs below the drain outlets.
5. Read staff gauge in the drain outlet channel.
6. Calculate the total drain flow

The main embankment was inspected from the upstream face to the toe. No changes or anomalies were noted.

The piezometer readings were made in all the piezometers and were normal with no anomalies found in any reading. The staff gauge in the stream below the drains was recorded at 0.78 ft. for a total flow from the drains at 0.28 cfs (126 gpm). The outside of most of the drains were photographed. The drain flow was clear.

The piezometer data and drain flow data has been entered into the monitoring spreadsheet. Plots of the piezometers and the drain flow are provided in the report.

The crack in the center of the box culvert was checked and there are no signs of movement or differential settlement.

Chapman Construction has completed caulking of the cracks in the open chute spillway. All of the visible cracks were cleaned and filled with a Sika Flex Caulk. Chapman Construction also patched several large spalled concrete areas. The work was done on the concrete patches in cold weather and it appears that the surface of the concrete used in the patches did not fully hydrate before it was frozen. The surface of the frozen patched areas will need to be cleaned down to solid concrete and re-patched.

There was snow and ice in the open chute spillway so no inspection was made in the open chute spillway. There were no visible differences or anomalies.

TABLE OF CONTENTS

INTRODUCTION

The Kootenai Development Impoundment Dam is an earthen tailings impoundment dam located in the NW ¼ of Section 22 in Township 31 North, Range 30 West in Lincoln County, Montana. The dam is located at the confluence of Rainy Creek and Fleetwood Creek, which are tributary to the Kootenai River.

On Wednesday December 26th, 2007 a routine monitoring was completed on the project. Those in attendance were Kurt Hafferman from Billmayer & Hafferman Engineering, and Jeff Robertson from Chapman Construction.

The Kootenai Development Impoundment Dam is located on a US EPA Superfund site and access to the dam is restricted. The on site hazard is asbestos. All personnel involved in this inspection are 40-Hour HAZWOPER trained, are medically monitored, are medically certified to wear respirators, and have all been fit tested for appropriate respirators.

The purpose of the project was to complete routine planned maintenance and develop a plan and schedule for completing the future maintenance.

HAZARDOUS WASTE AND EMERGENCY OPERATIONS (HAZWOPER) PLAN

The HAZWOPER Project manager and Field Leader for this site inspection was Kurt Hafferman. The decontamination supervisor and field assistant and the Health and Safety Officer was Jeff Robertson. Site security was provided by the US EPA at the entrance to the project. The Personal Protective Equipment (PPE) used was North Full Face® respirators with P-100 filters (purple), double layer Tyvek® suits with Tyvek® booties, cotton glove liners with rubber outer gloves and rubber over booties.

SITE INSPECTION RESULTS

A copy of Periodic Investigation Report and the field inspection notes are enclosed in Exhibit 1 to this report. The following report will provide details to the Periodic Investigation Report and the field notes and will comprise the body of the December 26th, 2007 Routine Inspection Report.

Reservoir

There was water in the reservoir to but it was approximately 1000 ft. away from the upstream face of the dam on the date of the inspection. There was no water at the base of piezometer P-O. There was nothing unusual noted in the reservoir or on either side of the reservoir, near the dam or in the drainage above the reservoir.

Piezometers

All but one of the piezometers was located and a reading was obtained from each one except P-O which was not read on the day of this inspection. Piezometers P, P1, P3, P4, P5, PM2, PM3, PM4 and PM6 were noted as dry. Piezometers P2, PM1, and A-8 had a measurable water depth. The fence post near Piezometer PM5 and been removed and the top was covered with snow so it could not be located. The fence post needs to be replaced in the spring of 2008.

Piezometer A8 which has the highest column of water is at the toe of the dam. The reading in A8 on November 9th, 2007 was recorded as 8.75 ft below top of casing. The reading on the day of this inspection was 8.52 ft. below top of casing which is a rise in water surface of 0.23 ft. It is assumed that this rise is form rains that occurred in late September and October that are beginning to route through the dam.

Copies of the updated piezometer data and graphs are shown in Exhibit 2.

Concrete Box Culvert

The box culvert trash rack, which is made up of 13 – I-beams driven vertically into the soil, was clean of debris.

The inside of the box culvert was inspected from the entrance to the exit. The crack in the invert of the culvert that runs the full length of the culvert was noted as having no change from the November 9th, 2007 inspection.

Open Concrete Chute Spillway

The open chute spillway was inspected from the outlet of the box culvert to the bottom of the steep section of the chute. The sidewall load cracks and the pieces of the wall top that had spalled or cracked off have been cleaned and caulked and the spalled concrete sections have been repaired. The methods used to complete the repairs were discussed with Jeff Robertson of Chapman Construction.

All of the side wall load cracks and the stress cracks were first ground out with a diamond tipped blade on a hand held grinder. The cracks were cleaned and then filled with a stiff Sika Flex™ caulk. Each of the transverse expansion joints was also cleaned out and when necessary, a foam backer rod was installed in the joint and then the joint was filled over with the flowable Sika Flex™ caulk. The vertical side expansion joints were also cleaned, a foam backer rod installed and a stiff non flowable Sika Flex™ was used to cover the backer rod and joint. A photograph of the second transverse joint at the outlet from the box culvert is shown in Figure 1 below. The photograph shows the flowable and non flowable caulk difference.

Figure 1 Second Transverse Joint at top of Open Chute Spillway

All of the rest of the transverse expansion and vertical expansion joints in the spillway were cleaned and filled. The photograph above shows areas in the vertical joints where the backer rod moved or the caulk did not bond to the sides. Chapman Construction was instructed to go back and clean the sides again and reapply the caulk. These clean up projects will be completed in the spring of 2008.

Chapman Construction also cleaned and patched several of the spalled areas in the chute. Most of the smaller areas were cleaned and covered with a premixed concrete patch material. The larger spalled areas were cut with a diamond tip blade, cleaned with a grinding wheel or wire brush, painted with latex bonding agent and then a 4 to 1 sand to cement mix was placed in the spalled areas. Unfortunately the temperature was apparently to cold and many of the larger patches did not hydrate before they froze. Chapman Construction stated that they will go back and clean the patches out and replaced the patches in the spring of 2008. Therefore no pictures

were taken of these areas and further discussion will be made on these patches when they are redone.

There was ice in the steep section of the spillway so the steep chute was not inspected. The chute appeared to be in good condition as observed from the top of the spillway and no large cracks, displacements or anomalies were noted in the spillway floor or side walls. The same narrow side load cracks in the walls were cleaned and caulked in the steep chute has had been done in the other sections of the spillway. As discussed above, the larger spalled areas in the steep section were cleaned bit the patches had not hydrated and were frozen on the surface in November and will be repaired in the spring of 2008 by Chapman Construction.

Dam Crest

The crest of the dam was inspected from the right to the left side. There was no misalignment, bulges or depressions noted in the crest. Chapman Construction has removed the small brush on the crest and alignment of the crest is much easier.

Upstream Face

The upstream face of the dam was inspected from the right to the left side. There was no misalignment, bulges or depressions noted in the upstream face.

Downstream Face

The downstream face was inspected by walking each of the lift lines on the face. There was no misaligned sections, no bulges, cracks or significant erosion noted anywhere on the downstream face.

Toe Drains

The following toe drains were located and checked. There is no difference since the November 9th, 2007 inspection. Photographs were made and are included in Exhibit 3.

Drains 1: A 12-inch corrugated metal pipe in the left groin. The drain was dry. The drain was covered with snow on the day of the inspection so a photograph was not available.

Drain 2: A 12-inch corrugated metal pipe in the left groin. The drain had a small amount of water and was moist inside. The drain was covered with snow and a photograph was not practical.

Drain 3: Is an 8-inch concrete pipe near the left groin. The drain was running water. The drain was covered with snow and a photograph was not practical.

Drain 4: An 8-inch concrete pipe, with the bell end sticking out, in the left side, approximately 50 feet from left groin. The drain was flowing water and the flow was clear. The flow amount was typical for this drain. A photograph on the day of the inspection is shown in Figure 2 below;

Figure 2: Drain 4

Drain 5: Is a corrugated metal pipe near the center of the dam. The drain had a small amount of flow. The amount of flow is typical for this drain. The V-notch weir below this drain was noted as being 1 inch which is a flow of 2.35 gpm. The flow in the November 9th inspection was ¾ inch which is 1.15 gpm so the flow was slightly increased. A photograph of this drain is shown in Figure 3 below;

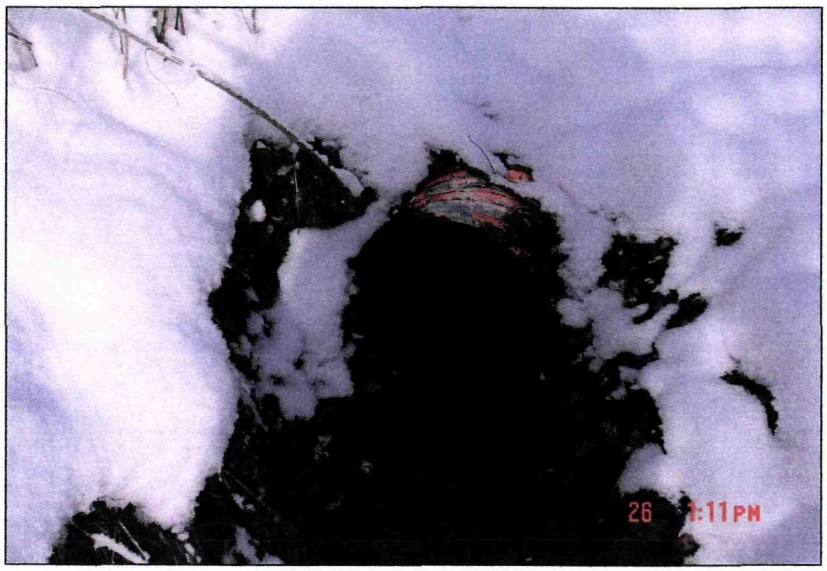


Figure 3: Drain 5

Drain 6: Is the large steel pipe in the center of the embankment. The flow was normal. The water depth was noted as being 11 5/8 inches down from the top inside. The November 9th measurement was 11 ¼ inches so this drain flow has decreased since the November measurement. A photograph of the drain is shown in Figure 4 below;

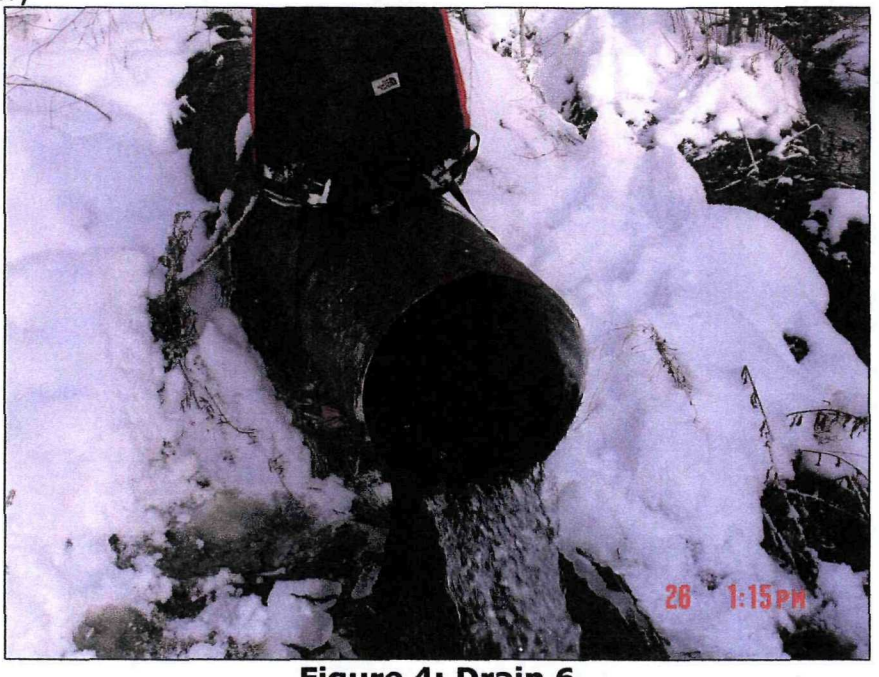


Figure 4: Drain 6

Drain 7 and Drain 8: Drains 7 and 8 are located together on the right side of the center of the embankment. Drain 7 is on top of Drain 8. Drain 7 is typically dry and was dry at this time. Drain 8 is an old CMP that is half buried in the silts. Drain 8 had a small amount of flow. Drain 7 was covered with snow and a photograph was not practical. Drain 8 is shown in Figure 5 below.

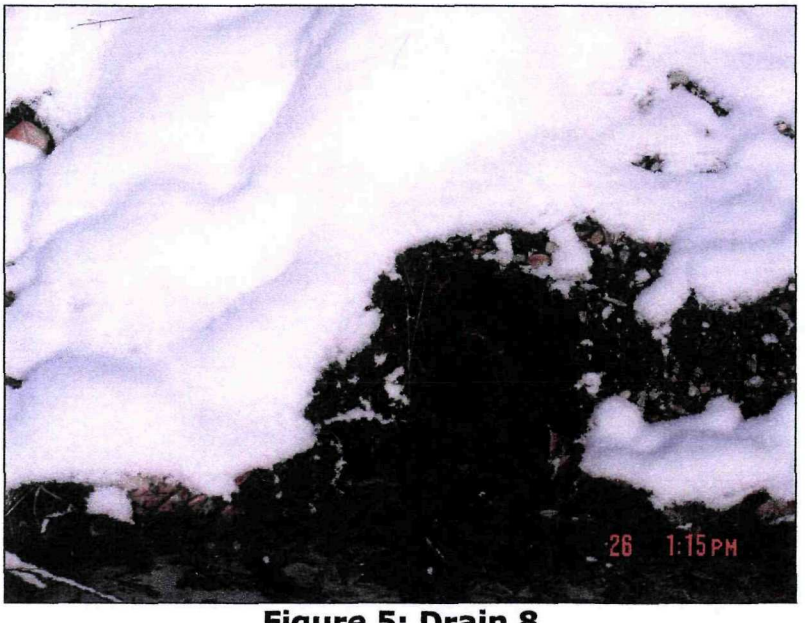


Figure 5: Drain 8

Drain 9 and Drain 10: are a pair of drains located approximately 100 ft. left of the right groin. Drain 9 is a CMP and Drain 10 is a concrete pipe drain. There was water flowing from both drains which is typical of these drains. The flow is clear. Photographs of the drains are shown in Figure 6 below. Figure 7 shows a close up of each drain.

Figure 6: Drain 9 and Drain 10

Figure 7: Close Up of Drain 10

Close up of Drain 9

Drain 11: Drain 11 is an 8-inch concrete pipe. The drain was flowing water as is typical of this drain. The flow was clear and was a normal amount. A photograph of the drain is shown in Figure 8 below:

Figure 8: Drain 11

Drain 12 was covered with snow and a photograph was not practical. The V-notch weir below the drain was read and the reading was 1-3/4 inches which corresponds to a flow of 9.43 gpm. The flow in November was also 9.43 gpm. The stream channel below Drain 11 and Drain 12 had the normal amount of water flow below the drains. The channel is shown in Figure 9 below.

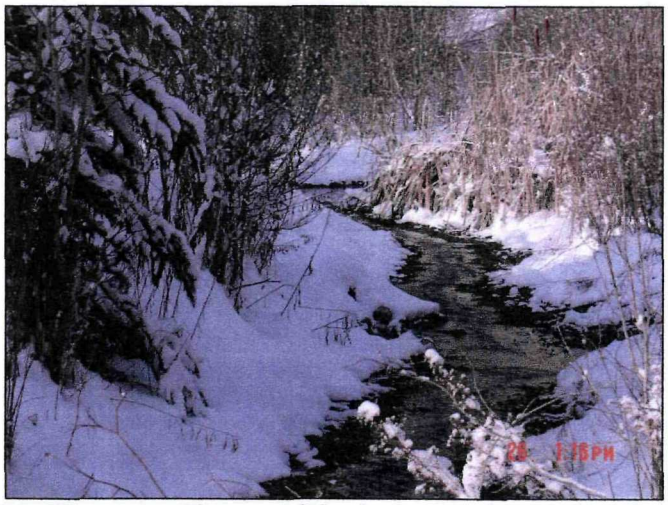


Figure 9: Stream Channel below Drain 11 and Drain 12

Main Channel: The staff gauge reading was taken. The staff gauge read 0.78 ft. After the November 9th, 2007 inspection the flow measurement data that had been taken the three previous inspections was used to develop a rating table for the staff gauge using FlowMaster®. A copy of the rating table is shown in Exhibit 4 to this report. The rating table estimates a flow rate of 0.28 cfs (126 gpm) which is the same as the November flow measurement.

Downstream Toe

The area downstream of the main embankment includes the area below the toe drain to the base of the concrete chute spillway. The area includes the stream from the drains, the left side access road, the right side access road area, and the stream down through the area to a culvert that goes under the access road that serves the left side of the dam. This is a large area that is heavily vegetated and is hard to inspect. A more thorough inspection of this area is planned for the spring of 2008 when the snow melts, before there are leaves on the trees.

The area could not be observed because of the heavy snow cover but showed no obvious signs of unusual seepage, no signs of bulges or displaced material and no other concerns or anomalies that were noted.

DISCUSSION

A. Emergency Action Plan: The Emergency Action Plan is current.

B. Operational Plan: The operational plan is up to date and needs no changes at this time.

C. Crest: There were no observed changes or differences in the crest.

D. Upstream face: There were no observed changes in the upstream face.

E. Piezometers: As discussed above, piezometer PM 5 was not found as the fence post next to the piezometer has been removed. It is not certain when it was removed but it is suspected that it may have been during hunting season. Although the area is a quarantined area, hunters do find ways into the site and it is suspected that it may have been taken at that time. The post will be replaced in the spring of 2008. It is also planned to place painted numbers and brass metal tags on each piezometer cap in the spring of 2008 as well.

F. Earthen Channel and Trash Rack above the Concrete Box Culvert: The trash rack was inspected and there were no accumulations of debris that need to be removed.

G. Concrete Box Culvert:
G.1. Entrance: No changes or observed issues.
G.2. Centerline Crack: The centerline crack has not changed since the November inspection.
G.3. Expansion Joints: No changes or anomalies noted.

H. Concrete Chute Spillway:

H.1. Transverse Expansion Joints in Floor and Side Walls: As noted above the expansion joints have been cleaned and caulked. The joints are in good condition.

Some of the vertical joints in the side walls still need caulked but other wise are in good condition.

H.2. Spalled Sections: As discussed above, most of the spalled sections have been patched. The smaller patches are completed and look good to excellent. The larger patches that were frozen before they hydrated will be cleaned and re-patched in the spring of 2008.

H.3. Open Chute Steep Section: The steep section is full of snow and ice and was not inspected.

I. Downstream Face: The downstream face was covered in snow and was not inspected. No changes or anomalies were observed.

J. Toe Drains: A total of twelve (12) toe drains were checked. The drains that are flowing water are normal and the flow is clear. No changes or anomalies were noted.

K. Monitoring: Normal monitoring activity with no significant changes or anomalies noted.

CONCLUSIONS AND RECOMMENDATIONS

It is the conclusion of Billmayer Engineering that the overall condition of the Kootenai Development Impoundment Dam remains good to very good. The crest, upstream face, downstream face, concrete spillway and earthen auxiliary spillway are all in good to very good condition. The maintenance and repair projects planned for the fall of 2007 have been completed. There are a few minor items yet to be completed and they are planned for the spring of 2008.

The blockage and debris in the drains continues to be investigated and repair, cleaning or replacement alternatives are being considered.

DAM SAFETY COMPLIANCE

Billmayer & Hafferman Engineering continue to perform the monthly monitoring, with assistance from one employee from Chapman Construction.

There are no issues or deadlines that will concern the Montana Dam Safety program. Preparation for the 5-year operational permit renewal inspection is still on track and the operational permit inspection is planned for early fall of 2008.

EXHIBITS

EXHIBIT 1

PERODIC INSPECTION REPORT AND FIELD NOTES

KOOTENAI DEVELOPMENT IMPOUNDMENT
DAM PERIODIC INVESTIGATION

Dam Name: KOOTENAI DEVELOPMENT IMPOUNDMENT
Dam Observer: HAFFERMAN & ROBERTSON
Reservoir Elevation: _____
Observation Date: DEC. 26, 2007
Weather Conditions: Partly cloudy @ 30°F

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
		EMBANKMENT				
CREST	1	SURFACE CRACKING	None			
	2	CAVE IN, ANIMAL BURROW	None			
	3	LOW AREA(S)	None			
	4	HORIZONTAL ALIGNMENT	good			
	5	RUTS AND/OR PUDDLES	None			
	6	VEGETATION CONDITION	Removed in early december by Chapman Const.			
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP	None			
	10	SLOPE PROTECTION	None			
	11	SINKHOLE, ANIMAL BURROW	None			
	12	EMB-ABUT CONTACT	Good			
	13	EROSION	None			
	14	VEGETATION CONDITION	Stumps, large trees and brush removed by			
	15		Chapman Const. in early December			
	16					

ADDITIONAL COMMENTS: REFER TO ITEM NO., IF APPLICABLE

Items #6 & Item #10 – Chapman Const has removed small trees & brush on the upstream face and the crest that was obcuring visuale inspections Old stumps and root wads removed and piezometers were exposed. Much easier to observe crest and upstream face

KOOTENAI DEVELOPMENT IMPOUNDMENT
DAM PERIODIC INVESTIGATION

Dam Name: _____

Dam Observer: _____ Observation Date: 12/26/07

Reservoir Elevation: _____ Weather Conditions: _____

AREA INSPECTED	ITEM NO.	CONDITION	EMBANKMENT (CONT'D) OBSERVATIONS	CHECK ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA(S) (NO FLOW)	None			
	18	SEEPAGE	None			
	19	SLIDE, SLOUGH, SCARP	None			
	20	EMB-ABUT CONTACT	Good			
	21	CAVE IN, ANIMAL BURROW	None			
	22	EROSION	None			
	23	UNUSUAL MOVEMENT	None			
	24	VEGETATION CONDITION	Minimal, some on left #1			
	25	REMOVAL OF TREES/SHRUBS (a)	Not at this time			
	26					
INSTRUMENTATION	27	PIEZOMETERS/OBSERV. WELLS	Water levels taken			
	28	STAFF GAUGE AND RECORDER	Staff gauge in stream below toe drains			
	29	WEIRS	3 - set below toe drains			
	30	SURVEY MONUMENTS	None			
	31	DRAIN'S	all checked and photographed			
	32	FREQUENCY READINGS	Monthly			
	33	LOCATION OF RECORDS	Billmayer & Hattermen, Kalispell			
	34					

ADDITIONAL COMMENTS: REFER TO ITEM NO., IF APPLICABLE

See field notes for drain weirs. GH in stream 0.78 ft Q = 130 gpm

(a) Trunk diameters larger than 2 inches.

KOOTENAI DEVELOPMENT IMPOUNDMENT
DAM PERIODIC INVESTIGATION

Dam Name: _____
Dam Observer: _____
Reservoir Elevation: _____

Observation Date: 12/26/07
Weather Conditions: _____

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ACTION NEEDED: MONITOR	INVESTI-GATE	REPAIR
			DOWNSTREAM AREA & MISCELLANEOUS			
DOWNSTREAM AREA	35	ABUTMENT LEAKAGE	None			
	36	FOUNDATION SEEPAGE	Yes around drains, see report			
	37	SLIDE, SLOUGH, SCARP	No			
	38	DRAINAGE SYSTEM	Functioning, some drains plugged, see report			
	39					
	40					
	41	HAZARD DESCRIPTION	NA - MT Dam Safety High Hazard			
	42	DATE OF LAST UPDATE OF EAP	June 8, 2007			
MISCELLANEOUS	43	RESERVOIR SLOPES	Good nothing noted			
	44	ACCESS ROADS	Good			
	45	SECURITY DEVICES	Excellent			
	46					
	47					
	48					
	49					
	50					

ADDITIONAL COMMENTS: REFER TO ITEM NO., IF APPLICABLE

KOOTENAI DEVELOPMENT IMPOUNDMENT
DAM PERIODIC INVESTIGATION

Dam Name: _____
Dam Observer: _____
Reservoir Elevation: _____

Observation Date: 12/26/07
Weather Conditions: _____

AREA INSPECTED	ITEM NO.	CONDITION	SPILLWAYS OBSERVATIONS	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
ERODIBLE CHANNEL	51	SLIDE, SLOUGH, SCARP	None, okay			
	52	EROSION	None			
	53	VEGETATION CONDITION	Some, okay at this point			
	54	DEBRIS	Some, okay at this point			
	55					
	56					
NON-ERODIBLE CHANNEL	57	SIDEWALLS	Good, recently caulked			
	58	CHANNEL FLOOR	Good, transverse joints caulked			
	59	UNUSUAL MOVEMENT	None			
	60	APPROACH AREA	Good			
	61	WEIR OR CONTROL	Good			
	62	DISCHARGE AREA	Good, some small trees			
	63	CRACK WIDTH-BOX CULVERT (a)	Mapped in November, see report			
	64					
DROP INLET	65	INTAKE STRUCTURE	Good			
	66	TRASH RACK	Good, no trash			
	67	STILLING BASIN	Good			
	68					
	69					

ADDITIONAL COMMENTS: REFER TO ITEM NO., IF APPLICABLE
Item 57 & 58 - Chapman Const. has completed cleaning and caulking cracks & transvers joints in spillway see report.

(a) Bottom of box culvert through dam.

KOOTENAI DEVELOPMENT IMPOUNDMENT
ROUTINE INSPECTION REPORT

Dam Inspector(s): Hafferman & Robertson Inspection Date: 12/26/07

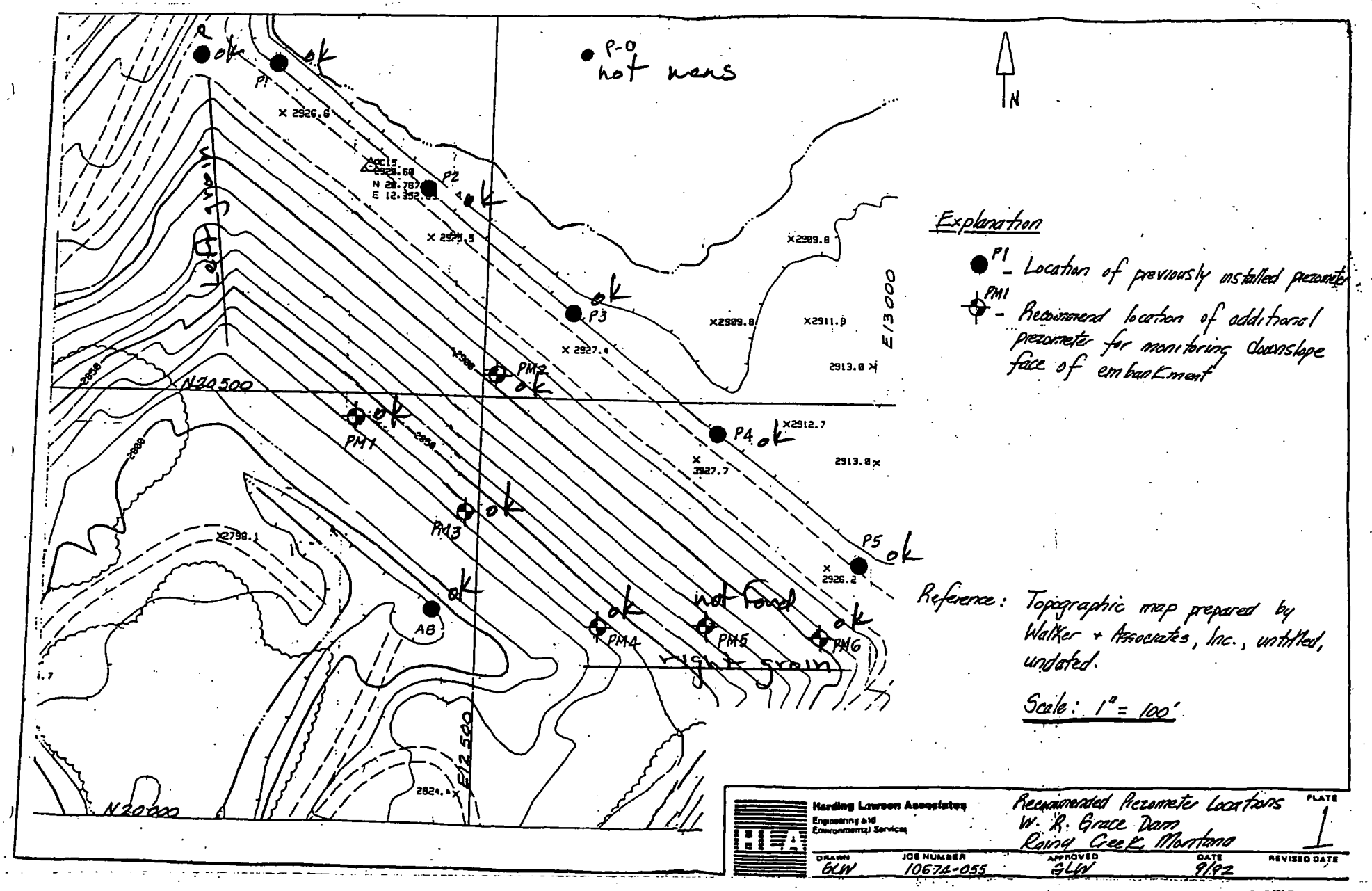
Reservoir Elevation: _____ Weather Conditions: _____

PIEZOMETER READINGS
(See Attached Drawing for Locations)

Piezometer ID	Depth Measured	Water Level	Dry	Piezometer ID	Depth Measured	Water Level	Dry
P0	Not meas.			PM1	54.81	51.52	~~wet~~
P	102.35	102.35	wet/dry	PM2	103.98	103.98	wet/dry
P1	103.4		dry	PM3	51.78		dry
P2		120.34		PM4	41.1		dry
P3	60.65		dry	PM5	Covered with snow		Not located
P4	106.2		dry	PM6	66.8		dry
P5	104.35		dry	A-8	28.26	8.52	

FINDINGS				
Inlet Box Culvert	Good			
Outlet Box Culvert	Good			
Emergency Spillway Inlet	Good			
Plunge Pool	Good			
Toe Drains	Fine see report			
Dam Observations	Good to excellent			
Areas of Concern	Toe drains see report			
Photos Taken		Yes ✓		No 12

Signatures _____


P-0
not mons
N
P1
ok
P2
ok
P3
ok
P4
ok
P5
ok
PM1
ok
PM2
ok
PM3
ok
PM4
ok
PM5
not found
PM6
ok
AB
ok
X 2926.6
X 2927.4
X 2927.7
X 2926.2
X2912.7
2913.8
X2909.8
X2911.8
X2798.1
2824.0
E13000
E12500
N20500
N20000
Explanation
P1 - Location of previously installed piezometer
PM1 - Recommend location of additional piezometer for monitoring downslope face of embankment
Reference: Topographic map prepared by Walker + Associates, Inc., untitled, undated.
Scale: 1" = 100'
Harding Lawson Associates
Engineering and Environmental Services
Recommended Piezometer Locations
W. R. Grace Dam
Rainy Creek, Montana
PLATE 1
DRAWN GLW
JOB NUMBER 10674-055
APPROVED GLW
DATE 9/92
REVISED DATE

000472

KD

12-26-07

Piezometers - Drains

Heffernan & Robertson

KID Wed. 12-26-2007 1/

partly cldy @ 30°F

11:33 @ Dam

snow last two days

Jeff & Kurt

well probe, camera

STN	Curr. read.	Current cond.	Previous cond.
P	102.35	dry/wet	previous
P1	103.4	dry	104
P2	120.34	wet	wet
P3	60.65	dry	60.5 dry
P4	106.2	dry	106 dry
P5	104.35	dry	very dry
LTOP PM-6	66.8	dry	65 dry
1st grn			
2nd top left PM-7	103.98	wet/dry	104 dry
3rd left PM-5			50 wet/dry
left grn			

2/9

102.35 wet @ bottom

(104) top appears broken, new max R -0.6 since last reading

Jeff's say 122.05 for bottom of P2

something hanging up @ 65

104.4 bottom Jeff

50 wet/dry Kurt

STA.		Current Read.	Current cond.	Prev. cond.
		Current		Prev.
2nd lift. left grant	PM 4	41.1	dry	41.
2nd lft	PM 3	51.78		51.5 dry
2nd lift.	PM 1	51.52	wet	51.65 wet
A8		8.52	wet	

bot. left. - 64.81

28.24

DRAINS from left to right looking downstream

Drain #	comment
D1	dry
D2	wet ≈ 3-5 gpm
D3	dry in pipe wet east of toe
D4	wet ≈ 3-5 gpm
W1234	0.5 inches
WD5	1.0 inches
D6	11 5/8" inches
D7	dry
D8	wet

additional comment

$V\text{-notch} = Q = 2.49H^{2.48}$

$Q = 2.49\left(\frac{1}{12}\right)^{2.48}$

photo $Q = 0.0052$ cfs

$Q = 2.35$ gpm.

photo Standard Contracted

~~photo~~ 1 ft rec weir $Q = 3.33 * (L - 0.2H) H^{3/2}$

photo $Q = 3.33(1 - 0.2(0.0417)) * 0.0417^{3/2}$

12" steel pipe photo $Q = 0.028$ cfs

$Q = 12.6$ gpm

conc. below D6

CMP below D7

St.	Comment	
staff gauge	G.H. 0.78	
D9	5-7 gpm	
D10	10-12 gpm	CMP
D11	8-10 gpm	conc.
D12	1 3/4 inches over v-notch	clear
Depart site @ 2:30 depart trailer @ 2:45		@ trailer

additional comments

+ In creek below all drains

clear

clear steady flow

clear steady flow

D-12 ≈ 10-15 gpm

≈ 5-10 gpm on right side of drain

D12 $Q = 2.49(H)^{2.48}$

$Q = 2.49\left(\frac{1.75}{12}\right)^{2.48} = 0.0210\ cfs$

$= 9.34$ gpm

All drains flowing normal amounts. All flow clear.

Piezometers normal height

Observed crack repair. Some of the patches appear to have frozen as they flaked off and did not appear to have hydrated

- most cracks looked good
- some were excellent

overall good to e

EXHIBIT 2

PIEZOMETER DATA AND UPDATED PIEZOMETER PLOTS

BILLMAYER ENGINEERING
KOOTENAI IMPOUNDMENT DAM R.56.1
FALL 2007 MAINTENANCE PROJECTS
HAFFERMAN
SEPTEMBER 27, 2007 PIEZOMETER READINGS

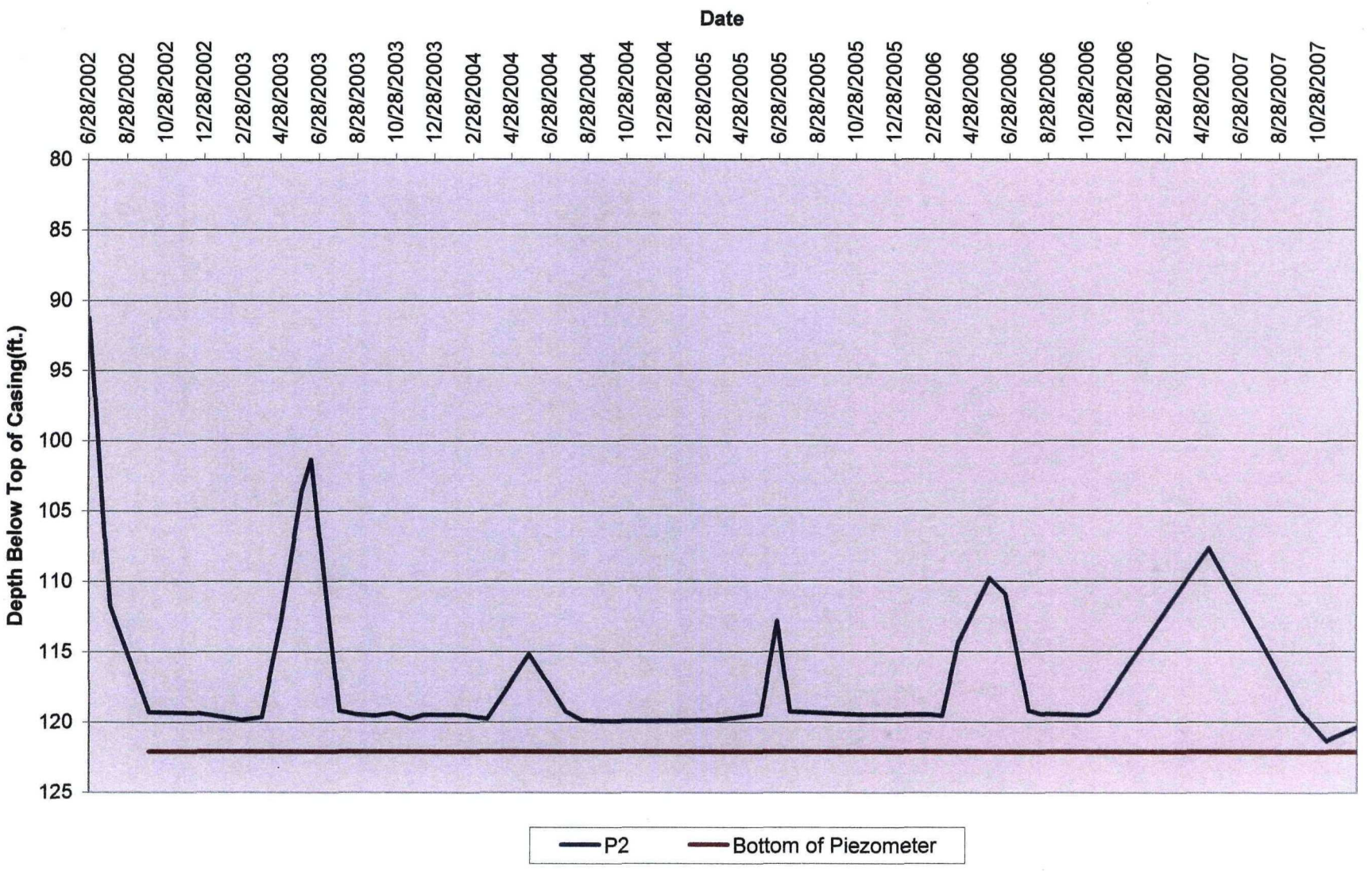
Piezometer Number	DISTANCE TO WS	TOTAL DEPTH	WET	DRY	WATER COLUMN DEPTH
P-O	NA	NA			
P1		103.93		DRY	
P2	110.23	122.1	WET		11.87
P3		60.7		DRY	
P4	106	106.2	WET		0.2
P5	104.01	104.3	WET		0.29
PM1	51.56	54.8	WET		3.24
PM2	103.12	104.6	WET		1.48
PM3		51.8		DRY	
PM4		41.12		DRY	
PM5		49.57		DRY	
PM6		65.69		DRY	
A8	7.22	28.3	WET		21.08

BILLMAYER & HAFFERMAN ENGINEERING
KOOTENAI IMPOUNDMENT DAM R.56.1
NOVEMBER 9, 2007 ROUTINE INSPECTION
HAFFERMAN
NOVEMBER 9, 2007 PIEZOMETER READINGS

Piezometer Number	DISTANCE TO WS	TOTAL DEPTH	WET	DRY	WATER COLUMN DEPTH
P-O	NA	NA			
P	DRY	102.35		DRY	
P1		104		DRY	
P2	121.3	122.5	WET		1.2
P3	DRY	60.3		DRY	
P4	106	106.2	WET		0.2
P5	104.01	104.3	WET		0.29
PM1	51.65	54.9		DRY	3.25
PM2	DRY	104			
PM3		50.3		DRY	
PM4		41.12		DRY	
PM5		49.57		DRY	
PM6		65.69		DRY	
A8	8.75	28.3	WET		19.55

BILLMAYER & HAFFERMAN ENGINEERING
KOOTENAI IMPOUNDMENT DAM R.56.1
DECEMBER 26, 2007 ROUTINE INSPECTION
HAFFERMAN
DECEMBER 26, 2007 PIEZOMETER READINGS

Piezometer Number	DISTANCE TO WS	TOTAL DEPTH	WET	DRY	WATER COLUMN DEPTH
P-O	NA	NA			
P	DRY	102.35		DRY	
P1		103.4		DRY	
P2	120.34	122.5	WET		2.16
P3	DRY	60.65		DRY	
P4	106.2	106.2	WET		0
P5	104.01	104.3	WET		0.29
PM1	51.52	54.81	WET		3.29
PM2		103.98		DRY	
PM3		51.78		DRY	
PM4		41.12		DRY	
PM5		49.57		DRY	
PM6		65.69		DRY	
A8	8.52	28.26	WET		19.74


Depth to Water in P2
Date
6/28/2002
8/28/2002
10/28/2002
12/28/2002
2/28/2003
4/28/2003
6/28/2003
8/28/2003
10/28/2003
12/28/2003
2/28/2004
4/28/2004
6/28/2004
8/28/2004
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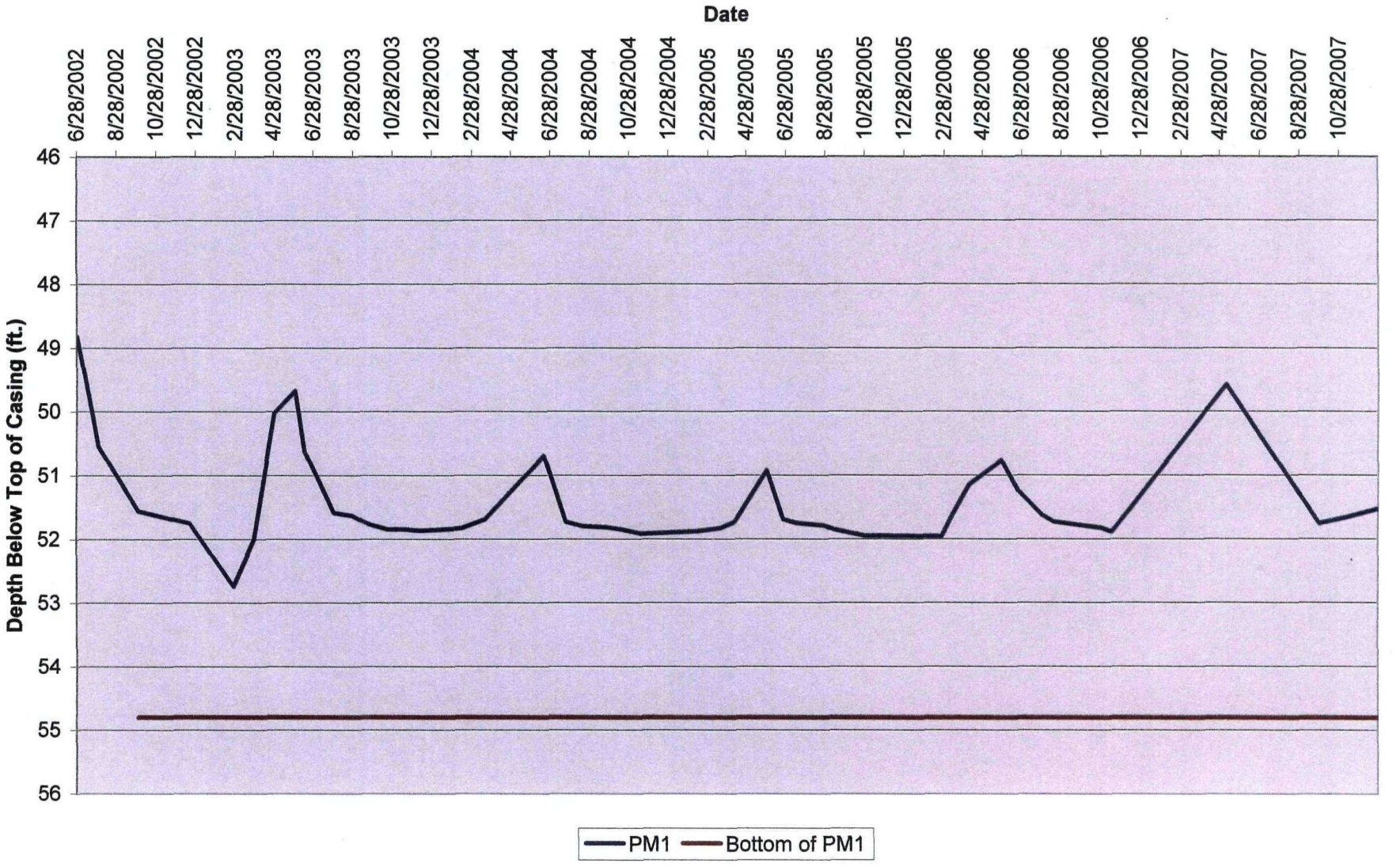
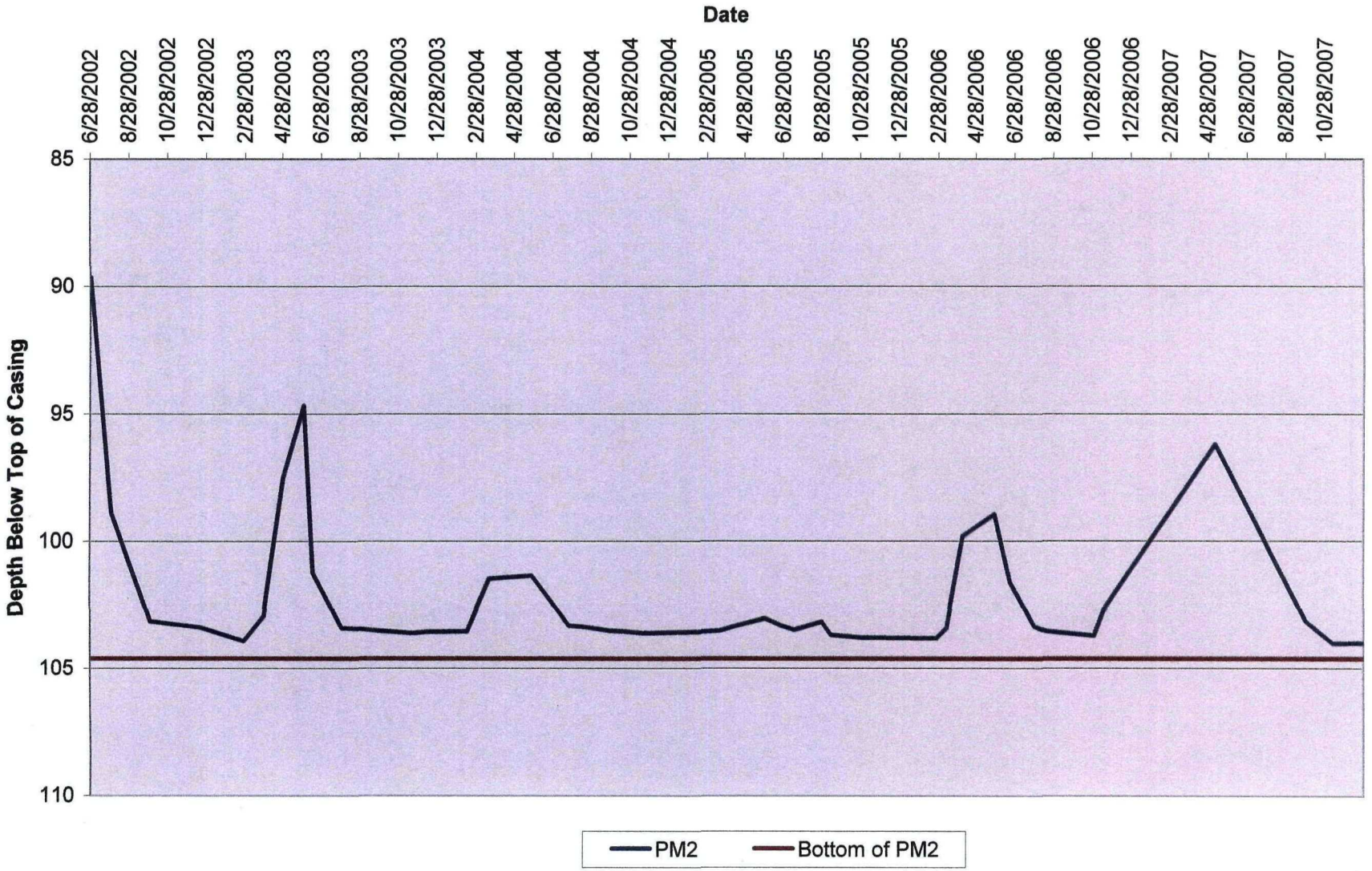
6/28/2006
8/28/2006
10/28/2006
12/28/2006
2/28/2007
4/28/2007
6/28/2007
8/28/2007
10/28/2007
Depth Below Top of Casing(ft.)
80
85
90
95
100
105
110
115
120
125
P2
Bottom of Piezometer

Depth to Water in PM1



Depth to Water in PM2



Depth to Water in Piezometer A8

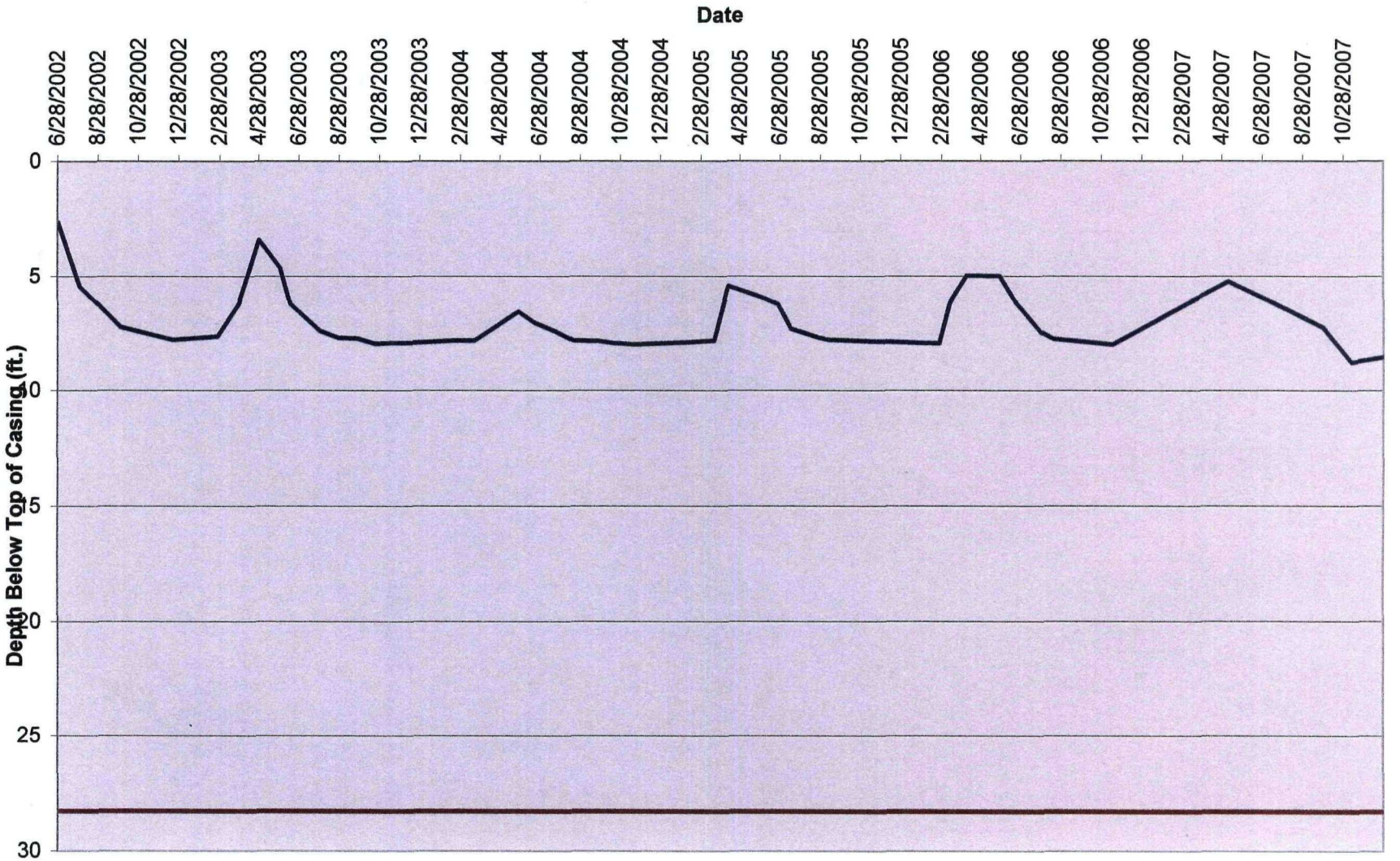
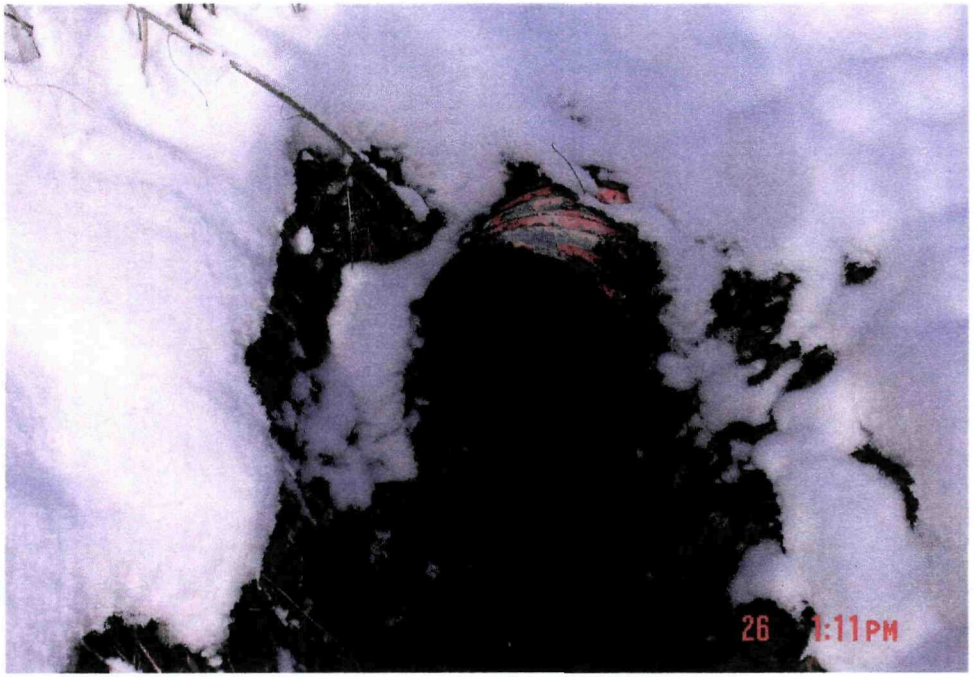
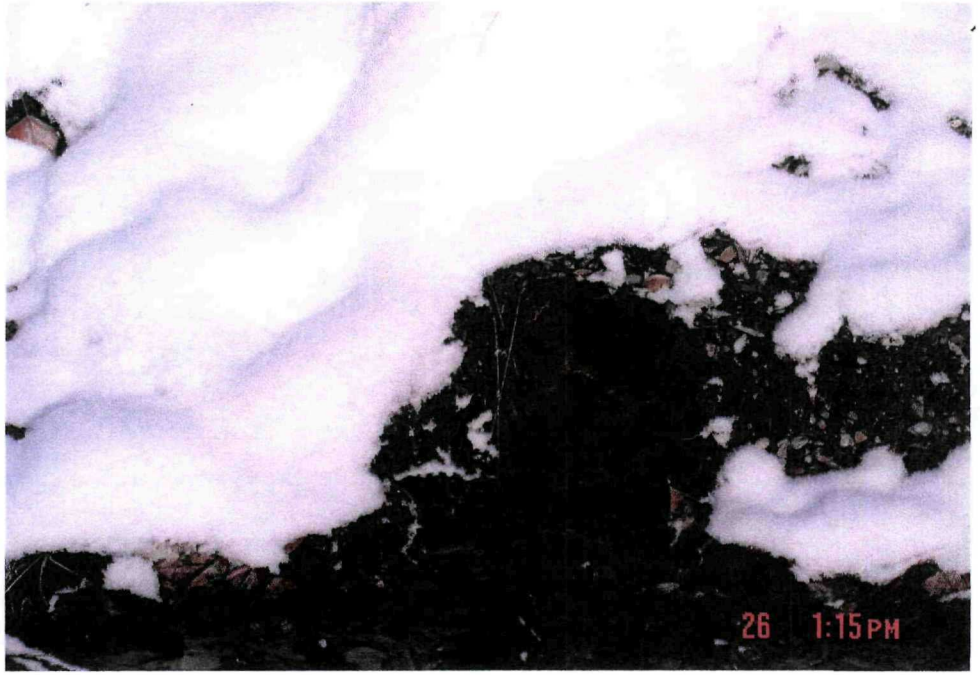
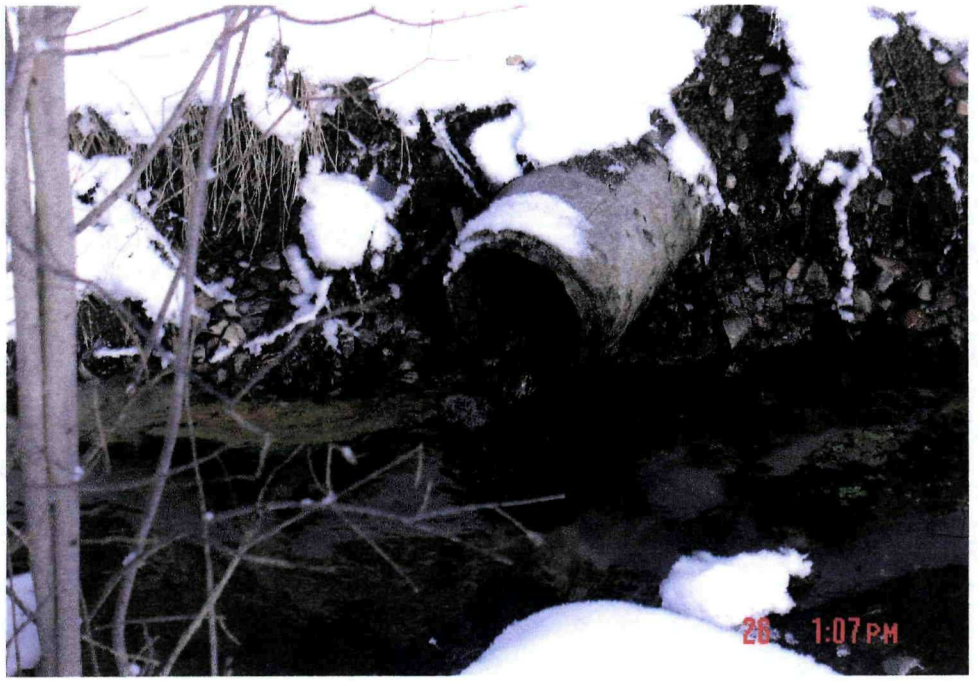


EXHIBIT 3

PHOTOGRAPHS


26 1:11PM


26 1:15PM


26 1:07PM


26 1:15PM

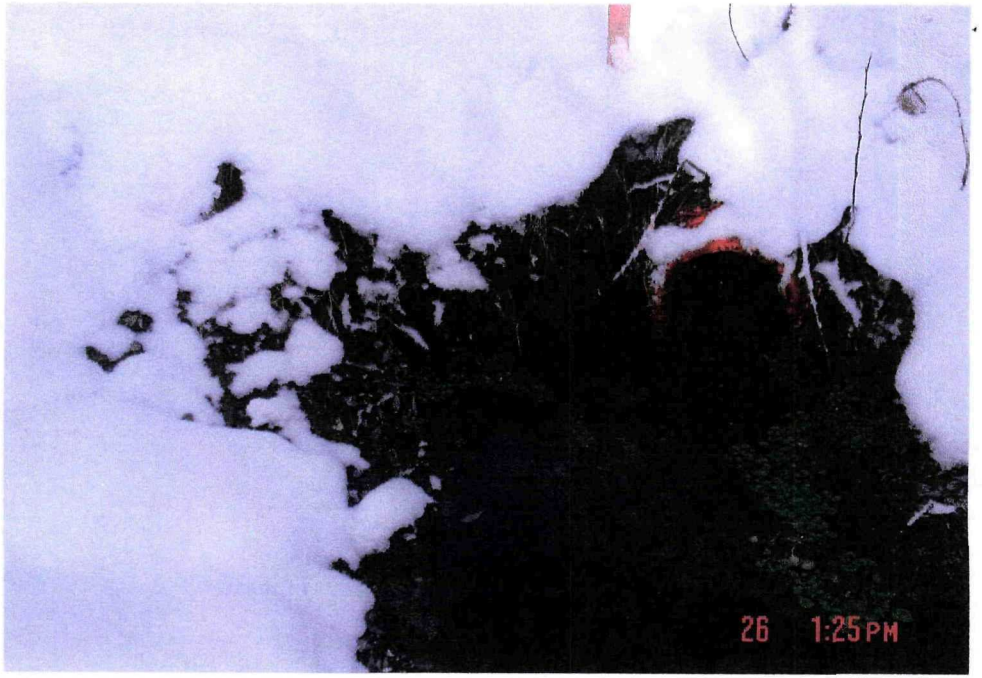

26 1:19PM


26 1:23PM


26 1:16PM


26 1:21PM


26 1:23PM


26 1:25PM


26 1:23PM


26 1:25PM

EXHIBIT 4

FLOWMASTER® RATING TABLE, CROSS SECTIONS AND INPUT DATA

Toe Drains Kootenai Impoundment Dam
Worksheet for Irregular Channel

Project Description	
Project File	\\server1\users\document\job files\jobs\r\r_56_01\documents\stream g.fm2
Worksheet	Stream Gauge Below Drains
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.000491	ft/ft
Water Surface Elevation	0.79	ft

Elevation range: 0.43 ft to 1.50 ft.

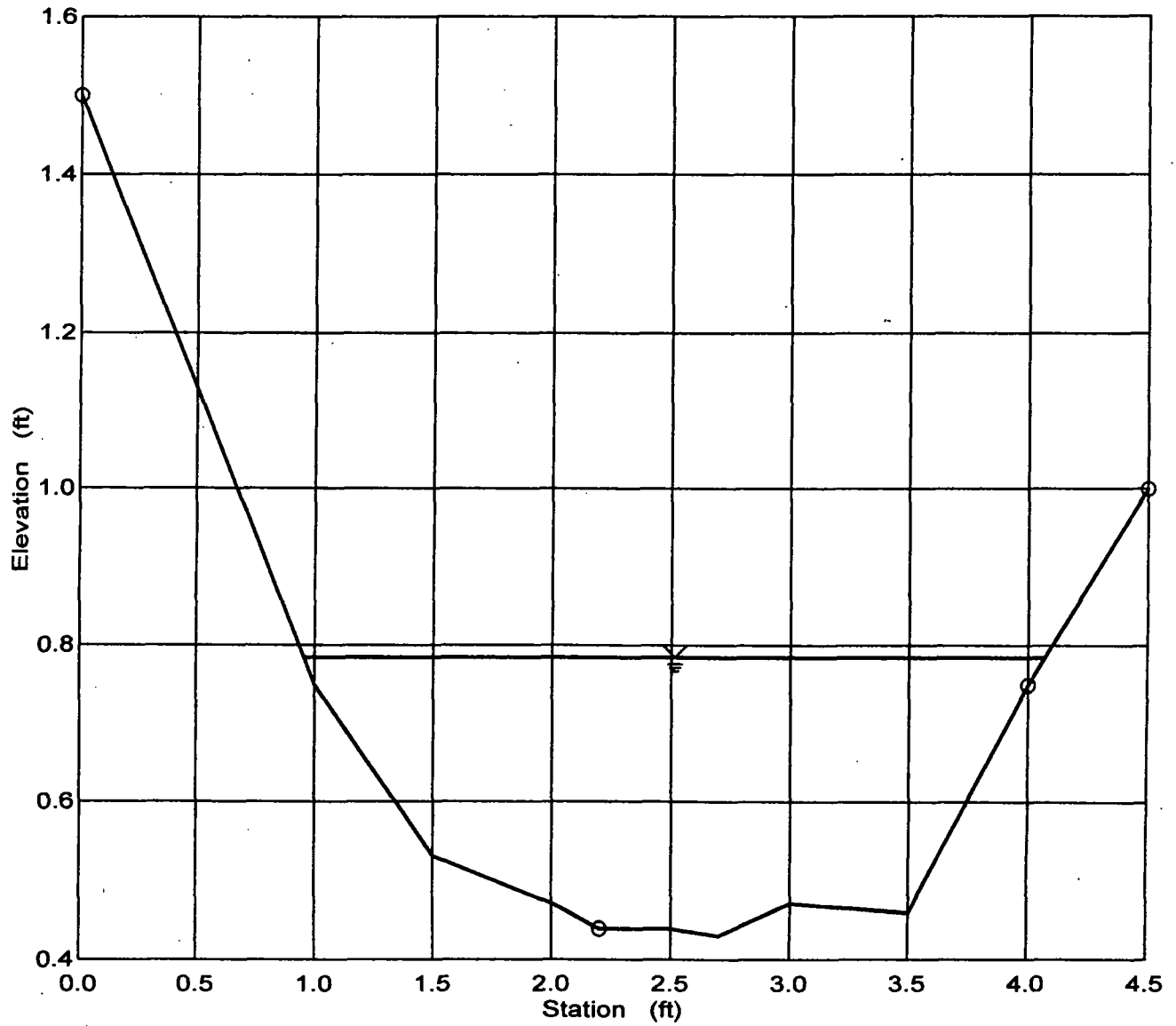
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1.50	0.00	2.20	0.035
1.00	0.75	2.20	4.00	0.038
1.50	0.53	4.00	4.50	0.035
2.00	0.47			
2.20	0.44			
2.50	0.44			
2.70	0.43			
3.00	0.47			
3.50	0.46			
4.00	0.75			
4.50	1.00			

Results		
Wtd. Mannings Coefficient	0.036	
Discharge	0.29	cfs
Flow Area	0.81	ft²
Wetted Perimeter	3.27	ft
Top Width	3.12	ft
Height	0.36	ft
Critical Depth	0.55	ft
Critical Slope	0.046102	ft/ft
Velocity	0.36	ft/s
Velocity Head	0.2e-2	ft
Specific Energy	0.79	ft
Froude Number	0.12	
Flow is subcritical.		

Cross Section at Staff Gauge; Toe Drains at Kootenai Impoundment Dam
Cross Section for Irregular Channel

Project Description	
Project File	\\server1\users\document\job files\jobs\r\r_56_01\documents\stream g.fm2
Worksheet	Stream Gauge Below Drains
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.036	
Channel Slope	0.000491	ft/ft
Water Surface Elevation	0.79	ft
Discharge	0.29	cfs

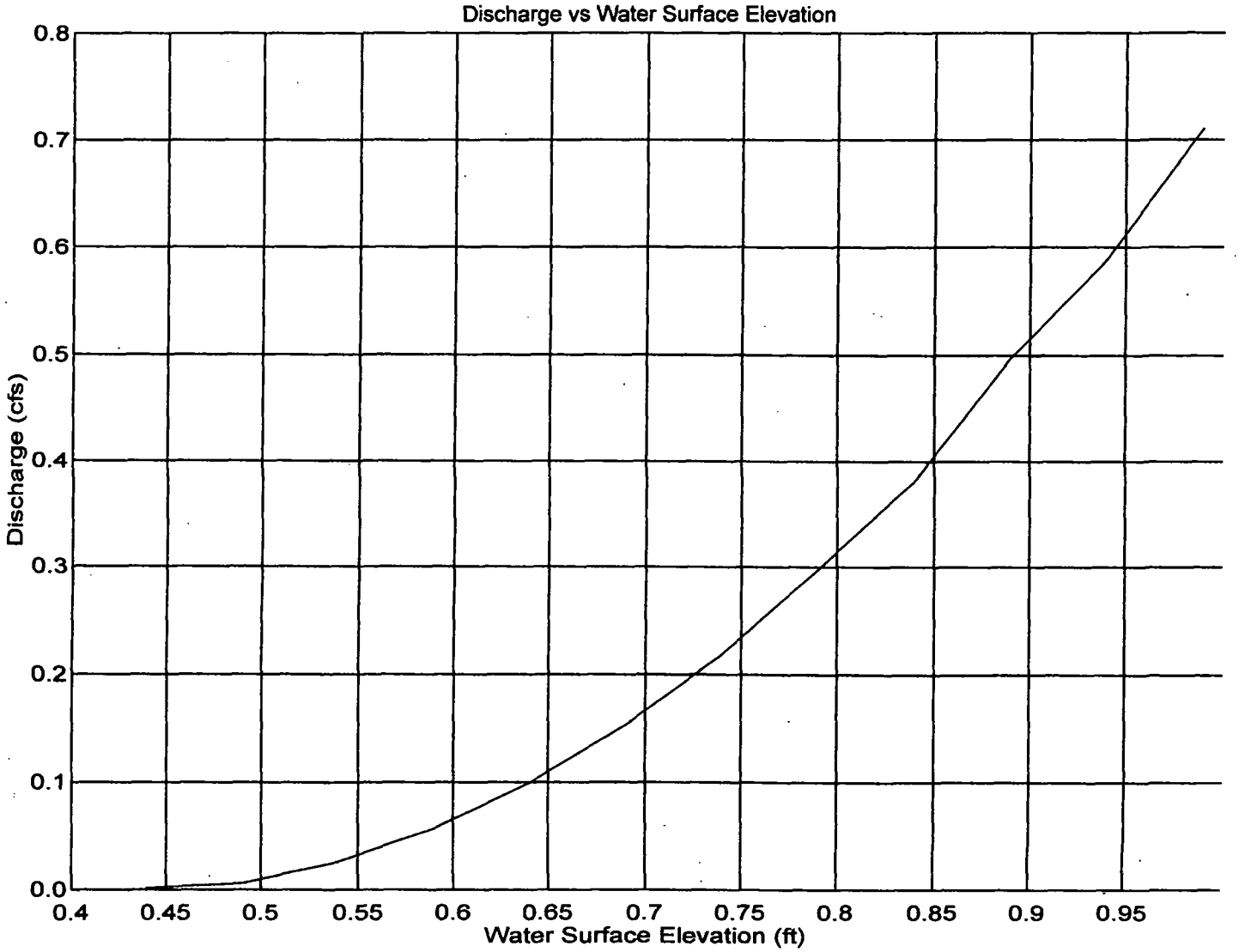


Curve
Plotted Curves for Irregular Channel

Project Description	
Project File	\\server1\users\document\job files\jobs\r\r_56_01\documents\stream g.fm2
Worksheet	Stream Gauge Below Drains
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Channel Slope	0.000491 ft/ft

Input Data			
	Minimum	Maximum	Increment
Water Surface Elevation	0.44	1.00	0.05 ft



Stream Gauge for Toe Drains at the Kootenai Impoundment Dam
Rating Table for Irregular Channel

Project Description	
Project File	\\server1\users\document\job files\jobs\r\r_56_01\documents\stream g.fm2
Worksheet	Stream Gauge Below Drains
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Channel Slope	0.000491 ft/ft

Input Data			
	Minimum	Maximum	Increment
Water Surface Elevation	0.43	1.00	0.01 ft

Rating Table

Water Surface Elevation (ft)	Wtd. Mannings Coefficient	Discharge (cfs)
0.43	0.036	0.00
0.44	0.038	0.35e-4
0.45	0.037	0.34e-3
0.46	0.037	0.97e-3
0.47	0.038	0.17e-2
0.48	0.037	0.34e-2
0.49	0.037	0.01
0.50	0.037	0.01
0.51	0.037	0.01
0.52	0.036	0.02
0.53	0.036	0.02
0.54	0.037	0.02
0.55	0.037	0.03
0.56	0.037	0.04
0.57	0.037	0.04
0.58	0.037	0.05
0.59	0.037	0.06
0.60	0.037	0.06
0.61	0.037	0.07
0.62	0.037	0.08
0.63	0.037	0.09
0.64	0.037	0.10
0.65	0.037	0.11
0.66	0.037	0.12
0.67	0.037	0.13
0.68	0.037	0.14
0.69	0.037	0.15

Stream Gauge for Toe Drains at the Kootenai Impoundment Dam
Rating Table for Irregular Channel

Rating Table		
Water Surface Elevation (ft)	Wtd. Mannings Coefficient	Discharge (cfs)
0.70	0.037	0.16
0.71	0.037	0.18
0.72	0.037	0.19
0.73	0.037	0.20
0.74	0.037	0.22
0.75	0.037	0.23
0.76	0.037	0.25
0.77	0.036	0.26
0.78	0.036	0.28
0.79	0.036	0.30
0.80	0.037	0.31
0.81	0.036	0.33
0.82	0.036	0.35
0.83	0.036	0.37
0.84	0.037	0.38
0.85	0.036	0.41
0.86	0.037	0.42
0.87	0.035	0.45
0.88	0.037	0.46
0.89	0.035	0.50
0.90	0.037	0.50
0.91	0.035	0.54
0.92	0.035	0.57
0.93	0.036	0.57
0.94	0.036	0.59
0.95	0.036	0.61
0.96	0.036	0.64
0.97	0.036	0.66
0.98	0.036	0.69
0.99	0.036	0.71
1.00	0.036	0.74